SYSTEM FOR PROMPTING A CONTROL UNIT

The invention relates to a system for prompting a control unit in a transport device having a power circuit for the control unit in order to change this control unit from a normal operational state to a sleep mode, and having a prompting device which, when it is operated, switches the power supply through in order to change the control unit into the normal operational state.

In transport devices, particularly motor vehicles and airplanes, data bus systems are used by which the many individual control units are interconnected. For reducing the power consumption, the data bus as well as the control units can partially or completely be changed to certain modes in which control units operate at a full power consumption in the normal operational state or in a sleep state in which the power consumption is reduced.

In the case of transport devices, such interconnected systems, for example, a so-called CAN bus according to ISO 11519 or ISO 11898 are used in order to control engine functions or comfort functions in the vehicle interior. In recent years,

another specialization has taken place in the case of these data bus systems, so that additional data buses for brake-by-wire systems or for telecommunication, such as D2B or MOST data buses, are used. As a result of the high degree of interconnection, the problem now arises that the onboard power supply itself is loaded even when the transport device is switched off and actually no or only a few control functions are required. In order to reduce the power consumption in the sleep mode, the control units are switched off after a defined time, in which case it is necessary that the system can, for example, receive a signal from a transponder for the unlocking of a door or the like. For this purpose, it has to be possible to prompt the individual control units out of the sleep mode by means of the transponder or other operating switches or signals.

German Patent Document DE 197 15 880 C1 discloses a system having data-bus-interconnected control units. An individual control unit is provided as a master control unit and is equipped with a standby operating function with a prompting capability and is continuously active. In the inoperative state of the motor vehicle, the master control unit is in a standby state while the other control units are switched off. When the master control unit receives a prompt signal, it prompts the other control units by way of a control line, so that these control units are again supplied with current and can operate in their normal function.

German Patent Document DE 196 11 945 C1 reveals a system whose control units remain in an operational mode from which they can very rapidly be changed back into a normal operational state. For this purpose, a semiconductor device is switched in front of each control unit and in front of its bus protocol module, which semiconductor device can be supplied from a higher-ranking voltage potential and can be prompted from a sleep mode by means of a control input. The prompting operation takes place by way of a control signal as a result of which the above-mentioned semiconductor device switches through the power supply.

In the case of these known systems, at least one control unit always has to remain switched-on which, when necessary, can then prompt the remaining control units. In a sleep mode in which also the voltage regulator of the last control unit is switched off, the problem arises that the control units can no longer be prompted, because the switches for the prompting or the logic circuits, which are required for connecting the operating voltage for the control unit, are not supplied with current and are therefore also not operable. The reason is that a currentless operating switch cannot connect the power supply for the control unit. For example, during the prompting by a transponder, a logic circuit also has to be supplied with current. However, in the sleep mode, the current is not present

because the power supply is switched off and the switches or existing logic circuits are also supplied by way of the operating voltage of the respective control unit.

It is an object of the present invention to further develop a system for prompting a control unit such that individual control units can be changed from a sleep mode, in which the power supply of the control units is switched off, back into the normal operational state, without the requirement that a master control unit has to remain operative in order to provide electric power for the prompting operation.

According to the invention, this object is achieved by means of the characteristics of the independent Claim 1. Accordingly, the prompting device is not supplied with current in the sleep mode, and a dischargeable energy accumulator is provided so that, when the prompting device is operated, the power of the energy accumulator can be used for changing the control unit into the normal operational state, a switch being operable by means of the power of the energy accumulator, which switch connects the control unit to a power supply line.

In the case of the system according to the invention, a prompting device is provided which has at least one operating element, such as an operating switch, a remote control or an

access chip card. In addition, the prompting device can also provide a logic circuit which checks, for example, the access authorization by means of a security code, or the like. According to the invention, the prompting device has its own energy accumulator from which the power originates for the prompting operation and for the logic checking of the prompting request. As a result, the control unit assigned to the prompting device can be switched off because it does not have to remain operative for supplying power for the prompting device.

In a preferred further development of the invention, a voltage regulator arranged between the transport device battery and the control unit can also be switched off by the switch when the traffic device and thus the control unit are in the inoperative state. This is a considerable advantage because the service life of the voltage regulator is increased and the current consumption of the control unit is considerably reduced. In the normal operational state, the voltage regulator supplies the control unit with an operating voltage Vcc of, for example, 5 Volt, the voltage regulator being switched off in the inoperative state. The prompting device then closes, for example, during its operation, an electric switch, particularly a transistor or a relay. The switch then connects the control unit or the voltage regulator with the electric supply voltage U_Bat of the battery of the transport device.

The energy accumulator of the prompting device is charged when, during the operation of the prompting device, the mechanical operating force is converted to electric power. For this purpose, a piezogenerator or an energy generating device can be provided, in the case of which a metal body or wire is moved through a magnetic field, whereby a voltage is induced. As a result, the energy accumulator of the prompting device provides the electric power which is required for closing a switch in order to prompt the assigned control unit. In addition or as an alternative to the energy accumulator, an auxiliary energy accumulator can be charged in the normal operational state.

If a piezogenerator is provided in the prompting device, the latter can be coupled with a mechanical energy accumulator which then permits an energy conversion to electric power in order to operate a switch for prompting the control unit. By operating the operating switch of the prompting device, the piezogenerator generates an electric power which charges the energy accumulator of the prompting device. If the stored energy exceeds a threshold value, the energy present in the energy accumulator is supplied to a logic circuit assigned to the prompting device. The logic circuit then checks possibly defined switch-on conditions for the control unit and, if the result is positive, switches through the power supply of the traffic device, that is,

the transport device battery for the corresponding control unit, so that the latter can run up to the normal operational mode.

An electronic key for the access authorization to the motor vehicle can be provided without an own battery because, during the operation, the transmitting energy originates from the energy accumulator of the electronic key. Inside the motor vehicle, the electronic key can then be supplied with energy by way of the electromagnetic coupling, so that the energy accumulator provided as the accumulator can be additionally charged.

One advantage of the invention consists of the fact that the prompting device previously continuously supplied with current at the onboard power supply can be operated in the sleep mode independently of the onboard power supply. As a result, also an assigned control unit as a whole can be changed to a currentless state because the prompting device does not have to be supplied with current by the control unit. As a result of the present invention, the energy balance in the onboard power supply can be considerably improved in the sleep state of the data bus system. Components previously operated by the battery of the transport device can be provided without this power supply.

Different possibilities exist of advantageously further developing the teaching of the present invention. For this

purpose, reference is made, on the one hand, to the subclaims and, on the other hand, to the following explanation of an embodiment.

Figures 1 and 2 each show a circuit diagram for an electronic further development of the system according to the invention having a prompting device, an energy accumulator and the assigned control unit.

The system for prompting the control unit 1 has a prompting device 2 which, when an operating element 3 is operated, switches through the power supply for the control unit 1 by means of an electronic switch, for example, an electronic relay 4. By means of the switch 10, the control unit 1 can be changed to a sleep mode by a switch-off signal V_off generated by the software of the control unit 1, in that the connection between the control unit 1 and the battery voltage U_Bat is interrupted.

The system can be used in a data bus system, where many control units are mutually interconnected. During the operation of the transport device, particularly during the drive of a motor vehicle, the control units 1 are in a normal operational state, in which each control unit 1 is supplied by the battery voltage U_BAT. The operating voltages Vcc of, for example, 5 V, required inside the control unit 1 are generated by assigned voltage

regulators which are fed by the battery voltage U_Bat. At the control unit 1, all internal voltage regulators can be switched off in the sleep mode. Thus, no finite quiescent current, which is required for detecting a function demand, has to remain as in the state of the art. The advantage of the implementation introduced in the application is the fact that, in the sleep mode, the control unit 1 is virtually in a currentless state or, if required, consumes only a very low leakage current (< 1 µA).

The prompting device 2 is provided in order to switch the assigned control unit 1 from the sleep mode back into the normal operational state. In the sleep mode, the prompting device 2 is not supplied with current. During the operation of the operating switch 3 of the prompting device 2, the electric power generated in this case is charged into an energy accumulator 5; if required, a portion of the energy is also charged into an auxiliary energy accumulator 8. The auxiliary energy accumulator 8 is maintained in a charged condition from the battery 6 by way of a resistor. The energy of the energy accumulators 5 and 8 is used for generating for a few milliseconds the supply voltage for a pulse generator stage 7 (for example, in the CMOS technique) as well as the input signal for the pulse stage 7 by means of an input wiring 11 such that a reliable switching operation is caused.

For generating the prompting power, a so-called piezoelectric generator, abbreviated piezogenerator 9, can be used in which, as a result of the mechanical operating energy at the operating element 3, an electric power is generated by which the energy accumulator 5 is charged. The energy can then be used for the switching of the electric switches 4, 12, and additionally the electric power can permit reliability checks and diagnostic functions. A rectifier 14 can, in each case, be connected in front of the energy accumulator 5, which rectifier 14 permits the utilization of both polarities of the alternating voltage generated by the piezogenerator 9. Furthermore, the auxiliary energy generator 8 can supply a supplementary energy which supplements the energy made available from the energy accumulator 5 during the switch-on operation.

The output of the control pulse stage 7 provides a switching signal of a defined time length, for example, 1 ms, which first switches on the semiconductor relay 12. For switching on the semiconductor relay 12, a defined current is required which is supplied from the energy accumulator 5 and/or from the auxiliary energy accumulator 8. When an auxiliary energy accumulator 8 is present, the technical expenditures in the case of the prompting device 2 can be reduced because the energy accumulator may have smaller dimensions. The leakage current resulting from the auxiliary energy accumulator 8 is very low. By means of suitable

backup capacitors (for example, foil (membrane?) capacitors), the leakage current can be limited to values of below 10 nA.

The brief switching operation triggered in the relay 12 leads to the immediate switching on of the relay 4 which remains in a locking switching (operation?). The switch 10 is normally connected (switched through?) unless it receives a blocking signal V_off from the control unit 1. The switching-on of the relay 4 results in a switching of the battery voltage U_Bat onto the input of the semiconductor relay 12, so that the battery voltage 6 is switched through to the control unit 1. The switched current supply path for the control unit 1 is capable of meeting the current requirement needed by the control unit 1 in the normal operation. The power supply of the control unit 1 is interrupted by the providing of the switch-off signal V_off when the control unit 1 switches over to the sleep mode.

An unintentional switching-on of the control unit 1 by electromagnetic interference fields is virtually impossible because the interferences would have to be of such a high energy that they supply the pulse stage with voltage and, in addition, would have to maintain a relatively long input pulse for the pulse stage 7 in order to cause an unintentional switching.

Figure 2 illustrates another embodiment of the prompting

circuit. In contrast to the first embodiment, the locking function is implemented by a storage circuit 13, for example, in the CMOS method. The storage circuit 13 may have two fed-back NAND gates. During the entire time in which the control unit 1 works in the normal operation, the storage circuit 13 has to be supplied with voltage, so that the switch-off signal of the control unit can be processed. The power supply for the storage circuit 13 can, additionally to the supply from the short-term energy accumulator 5, take place either from the auxiliary energy accumulator 8 and/or from the switched-through supply voltage Vcc for the control unit 1. As a result, it is ensured that a switch-off signal V_off can be generated by the control unit 1 during the normal operation, it order to separate it from the battery voltage U_Bat. The energy accumulator 5 is not supplied from the auxiliary voltage source 8 or from the switched-through battery voltage Vcc, but, in the normal operation, is charged directly by way of the battery voltage U_Bat.

The switch 12 illustrated in Figure 2 may be an electronic relay or a discrete transistor circuit. After the prompting has taken place, the control unit 1 carries out its software-controlled function. This may also include the detection of the access authorization of the operating person. The energy required for detecting the access authorization is in this case supplied by the additionally connected supply voltage Vcc. When

the test result is negative, the control unit 1 can be uncoupled from the power supply. Particularly during closing functions in connection with the door of a transport device, the energy required for the checking of the access authorization can only take place (only be? translator) the energy generated during the prompting operation itself when all voltage regulators are switched off in the sleep mode.

The control unit 1 is supplied with the supply voltage Vcc which is provided by a voltage regulator. In the normal operational state, the voltage regulator provides the optimal operating voltage of the control unit 1. A logic circuit can be provided for checking the access authorization when the control unit 1 is to be switched into the normal operational state by the prompting device 2.